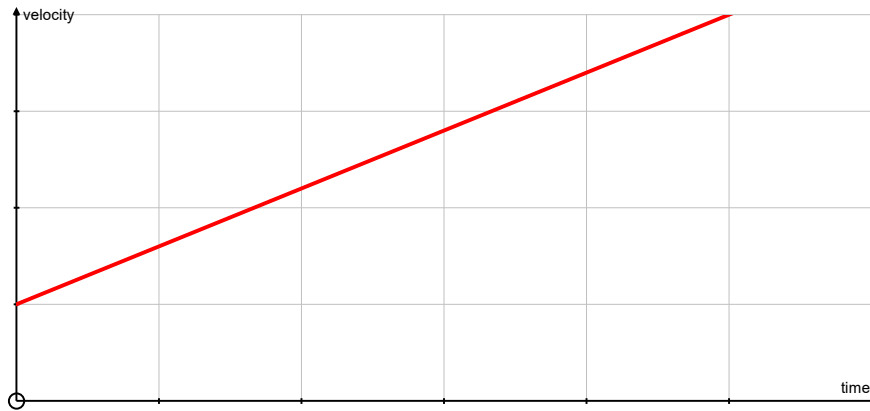


Proving the constant acceleration equations from a velocity-time graph

Symbols and units

Time of travel = t	seconds, s
Initial velocity = u	metres per second, ms^{-1}
Final velocity = v	metres per second, ms^{-1}
Acceleration = a	metres per second squared, ms^{-2}
Displacement = s	metres, m



1. First mark u , v and t on the graph above
2. Write down the change in y , and the change in x . Now use the fact that the acceleration is given by the gradient of the line to write an equation linking a, u, v and t . Rearrange to make v the subject of the formula. This is your first formula.

First Formula:

3. The area under the line is a trapezium. Write down the formula for area of a trapezium. Use the fact that displacement is given by the area under the line to get an equation linking s, u, v and t . This is your second formula.

Second Formula:

4. Substitute your first formula into your second formula (replacing v) and simplify to get an equation linking a, u, s and t . This is your third formula.

Third Formula:

5. Rearrange your first formula to make u the subject. Now substitute this into your second formula (replacing u) and simplify to get an equation linking s, v, a and t . This is your fourth formula.

Fourth Formula:

6. Now square both sides of your first formula. Factorise out a from two of the terms. Double both sides of your third formula and use this to replace the bracket in your squared formula, to get a formula linking u, v, a and s . This is your fifth formula.

Fifth Formula:

7. You have proved five equations. Explain why your proofs only work if the acceleration is constant.